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New PRODUCTS AND TECHNOLOGIES FOR Municipal Drinking Water and Wastewater

A special edition of Crystal Clear

IN his ISSUE

Upcoming Events

October 3-7	WEFTEC '98 Orlando, Florida
November 1-4	1998 Water Quality Technology Conference and Exhibition San Diego, CA

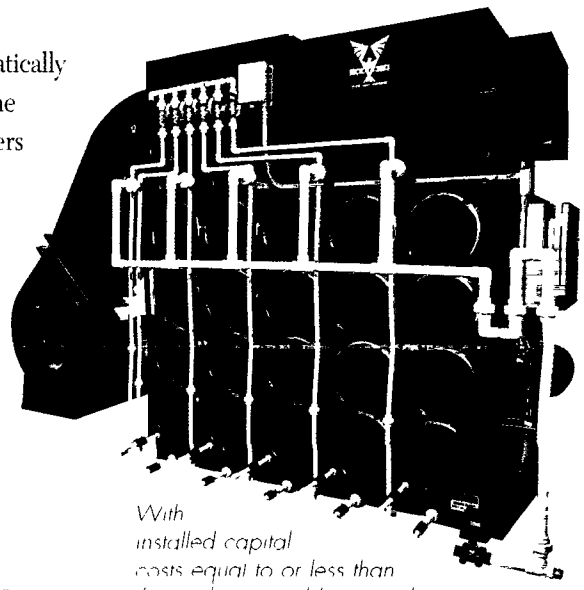
Phoenix™ Odor Control System: "The New and Better Mousetrap for Odor Control"

Municipal treatment professionals know that removing wastewater odors most often means removing H_2S. Three traditional "collect and treat" technologies for doing this are chemical wet scrubbers, biofilters and deep-bed activated carbon. All are effective, but each has inherent limitations.

New Approach to Odor Control

A new approach to odor control that fully utilizes the advantages of catalytic carbon is the Calgon Carbon Corporation Phoenix™ Odor Control System. The Phoenix™ system features a shallow-bed approach utilizing carbon canisters that allow radial air flow (see diagram this page). These pre-loaded canisters are arranged in rows of vertical banks. The foul air enters the top of the unit and is directed downward, flowing from outside to inside each individual canister. The treated air then flows upward through an internal distribution pipe and is exhausted through the exit side of the plenum.

Due to the canister design and an enhanced form of catalytic carbon, the Phoenix™ system allows for more effective water regeneration, dramatically extending the life of the carbon. The use of separate banks allows canisters to be regenerated sequentially, keeping the system on-line during this process. When the carbon eventually needs to be replaced, side entry portals allow each canister to be exchanged easily and quickly. The canisters can also be recycled, eliminating the need for landfill of spent material.



With installed capital costs equal to or less than those of wet scrubbers and operating costs as low as 50 percent of wet scrubbers, the Phoenix™ Odor Control system (shown here) can pay back your investment in just one to two years.

Advantages Payoff

The Phoenix™ system advantages are already paying off. Bill McCain, capital project engineer for Indian River County Utilities in Florida, says, "We were searching for a new and better mousetrap for odor control. We believe we found it in Phoenix™." The Oslo Drinking Water Plant in Indian River County where McCain works uses a degasifier—two 4000 cfm air strippers—to extract hydrogen sulfide (H_2S) from the water. Complaints from a nearby school caused McCain to seek a solution.

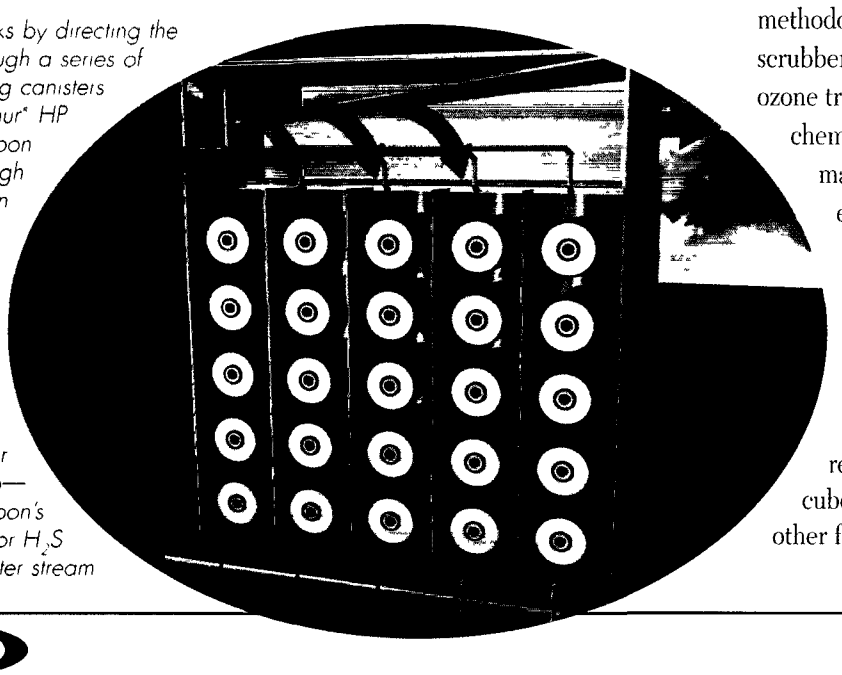
"I wanted an alternative to traditional methodologies such as two- or three-stage scrubber systems, biofiltration units and ozone treatment—all of which involve chemicals or high up-front cost and maintenance." The project engineer's determination to identify a less hazardous and less expensive treatment technology led him to Phoenix™.

Performance Advantage

McCain describes the Phoenix™ results as very impressive. "The bio cube and the wet scrubbers at our other facilities generate 92 to 97 percent removal. Phoenix™ has consistently achieved 97 to 98 percent removal." While McCain is obviously pleased with the cost savings, he perceives Phoenix's™ major advantage to be its lack of chemicals. "With Phoenix™, there are no chemicals whatsoever. If you're dealing with chlorine, you have the hazardous chemical waste aspect. With Phoenix™, that risk, that liability, that expense—they're all eliminated."

Choices for odor control solutions were limited to chemical wet scrubbers, biofilters and deep-bed systems utilizing impregnated activated carbon. Today, there is a new option with proven results: Phoenix™.

For more information about the Calgon Carbon Corporation Phoenix™ Odor Control System, contact Dan Brooks at 412-787-6813 or E-Mail: brooks@calgoncarbon.com



Phoenix™ works by directing the foul air down through a series of chambers containing canisters filled with Centaur® HP granular activated carbon. As the air passes through the radial-designed carbon beds, the H_2S is converted to H_2SO_4 due to Centaur's® unique catalytic nature. The loosely adsorbed and highly water-soluble H_2SO_4 is then washed off during the water regeneration step—restoring the carbon's capacity for H_2S groundwater stream.

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The World Leader In Activated Carbon Technology

A quarterly publication produced by Calgon Carbon Corporation for water treatment professionals

UV For Drinking Water

The Sentinel™ System—Crypto Barrier for Less Than 1¢ per 1,000 Gallons

"GOLD STANDARD" OF CRYPTO ASSAYS– MOUSE INFECTIVITY

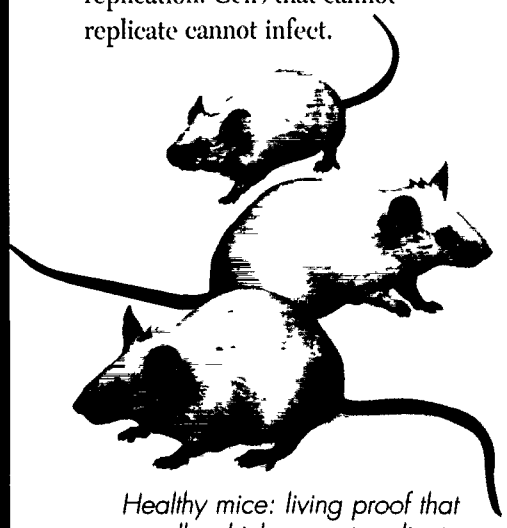
Cryptosporidium parvum assaying is an evolving science. The fastest and least expensive crypto viability assays are in vitro assays such as the vital dyes or the excystation tests that respond to damage to the cell wall. Using these assay methods, previous research indicates UV doses as high as 8,000 mW.s/cm² would be required to inactivate or "kill" crypto.

A NEW, HIGHER STANDARD

Calgon Carbon Corporation's Sentinel™ System design is based upon a more rigorous and reliable assay method. In vivo assaying, or mouse infectivity, measures the ability of the oocysts to infect a living body (mice), a more direct measure of the potential health effects of crypto. The in vivo assays prove that a UV dose as low as 25 mW.s/cm² provides greater than 4 log inactivation of crypto, or less than 1/320th of the UV dose previously thought necessary.

MEASURING OOCYSTS INFECTION POTENTIAL

The dramatic difference in UV dose requirement is attributed to the underlying measured parameter of the two tests. In vitro assays measure the damage to crypto's protective cell membranes. On the other hand, in vivo assays measure the ability of the oocysts to infect. When biological organisms absorb UV light in the range of 200-300 nm, the UV is absorbed by DNA and RNA which causes cross-linking of the double helix strands, and prevents strand splitting and replication. Cells that cannot replicate cannot infect.



Healthy mice: living proof that cells which cannot replicate cannot infect.

Is it possible to have a proven crypto barrier for less than 1 cent per 1,000 gallons? The answer is yes, now that Calgon Carbon Corporation has introduced its newest product, the Sentinel™ System, which uses UV disinfection to provide highly efficient cryptosporidium inactivation. Sentinel™ offers municipalities an extremely cost-effective, high-performance alternative to conventional cryptosporidium barriers such as ozone, membranes, chlorine dioxide and enhanced coagulation.

Superior Performance

The Sentinel™ System deactivates harmful parasites such as cryptosporidium and giardia at a fraction of the cost of other treatment methods. As the table at the right indicates, Sentinel's™ medium-pressure lamps achieve a greater than 3.5 log inactivation of crypto for less than one cent per 1,000 gallons[1]. Based on a comparison of operational costs, Sentinel™ outperforms conventional technologies by at least 300 percent. For overall performance, Sentinel™ is superior to any other technology.

[1] Based on results obtained for finished (i.e., filtered) waters

No Harmful Disinfection By-Products

In addition, unlike other technologies, Sentinel™ does not produce any harmful disinfection by-products. The low maintenance system has a flexible design for easy retrofitting into existing systems, and it boasts an easy-to-install, compact footprint. Fail-safe controls are fully automated.

Sentinel™ has broken new ground in UV disinfection of cryptosporidium. The system's effectiveness in deactivating crypto is based on the ability of low-wavelength, high-energy UV light to penetrate the cyst membrane and photochemically sterilize the internal cell. This high degree of effectiveness has been proven by the "gold standard" of crypto assays—mouse infectivity (see accompanying side-bar).

Now that Sentinel™ has been proven in full-scale testing, there is only one question: How much of a difference can Sentinel™ make for your drinking water system?

For more information about the Sentinel™ System, contact Rob Abernethy at 905-477-9242 or E-Mail: abernethy@calgoncarbon.com

Highly Efficient Performance

Based on a comparison of operational costs, Sentinel™ outperforms conventional technologies by at least 300 percent.

Sentinel™ vs. Conventional Technologies
Comparison for Typical 10 MGD Installation

	Sentinel™	Ozone	Membranes	Chlorine Dioxide	Enhanced Coagulation
Capital Cost ($000)	350 (1)	1,250	5,000	100	2,400
Operational Cost ($/1000G)	<0.01 (1)	0.085	0.35	>1.00	0.03
Effectiveness (# of logs inactivation)	>4	2-3	>4	1-2	1-2
Secondary Treatment Requirements	None	Minor	Major	None	Major
Retrofitability	Excellent	Poor	Poor	Excellent	Excellent
By-products	None	Bromate, AOC	None	Chlorite, Chlorate	None
Footprint	Small	Large	Large	Small	Small
Service Requirements	Infrequent	Occasional-Frequent	Occasional-Frequent	Occasional	Infrequent
Occupational/ Environmental Risks	Low	Medium	Low	Medium	Low

(1) Based on dose of 1kW/MGD

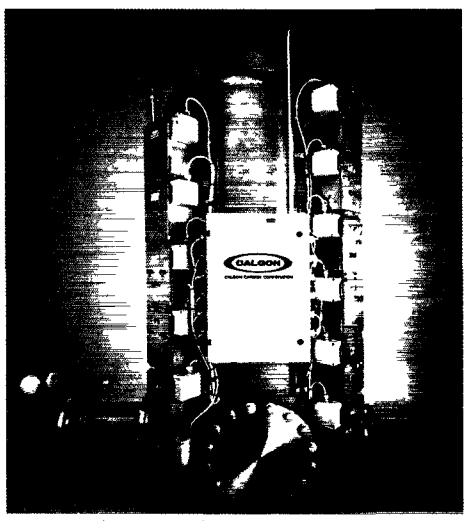
Source: Industry data - Spring 1998

The Rayox® Tower System–UV Oxidation for Drinking Water

History was made this summer when the first, full-scale UV/Peroxide system for drinking water treatment in North America started up in Salt Lake City, Utah. The Salt Lake City Department of Public Utilities selected Calgon Carbon Corporation's UV/Peroxide system to treat Tetrachloroethylene (PCE), which was found at low levels in a well in its public drinking water system. PCE is a suspected carcinogen commonly found in groundwater supplies and is regulated under the 1986 Safe Drinking Water Act.

Salt Lake City Selects UV/Peroxide Technology

Salt Lake City officials chose Calgon Carbon Corporation's 360 kW Rayox® Tower System, featuring UV/Peroxide technology, after conducting an analysis of other technologies, including air stripping and ozone. The tower system (shown at right) uses 12 x 30 kW lamps. The capital cost for the Salt Lake City system is $450,000, and operating costs are expected to be less than $0.20 per 1,000 gallons of treated water.



Calgon Carbon Corporation's Rayox® Tower System

"Unique Advantages"

Florence Reynolds, water quality and treatment administrator for Salt Lake City, notes, "We considered air stripping but felt that the technology was problematic because of the need to treat air emissions. We ultimately selected the Rayox® System technology because it has several unique advantages that other systems couldn't offer." (See advantages below.) Adds Reynolds, "The system also retains the well's full 3,000 gpm flow capacity because the UV/Peroxide system is able to effectively treat 100 percent of the water."

The Rayox® Tower System is currently being pilot tested for the treatment of MTBE and NDMA in drinking water sources.

For more information about the Rayox® Tower System, contact Rob Abernethy at 905-477-9242 or E-Mail: abernethy@calgoncarbon.com

UV OXIDATION ADVANTAGES

- On-site destruction treatment technology
- No formation of bromate ion in bromide ion-bearing waters
- Nondetectable levels achieved
- No secondary wastes
- No off-gases
- Quiet, compact and unobtrusive equipment
- Low maintenance and operating requirements
- Cost-effective for a wide range of contaminants

UV For Wastewater

The Aurora UV™ Disinfection System—High Power, High Performance Wastewater Disinfection

Need a better, faster, more cost-effective alternative to chlorination? Calgon Carbon Corporation's Aurora UV™ Disinfection System may be just what you need. The Aurora system uses ultraviolet (UV) light to damage the DNA in bacteria, viruses and other microorganisms found in wastewater. The damaged DNA is unable to replicate as a result of the exposure to the UV light.

Delta Wings Increase Performance

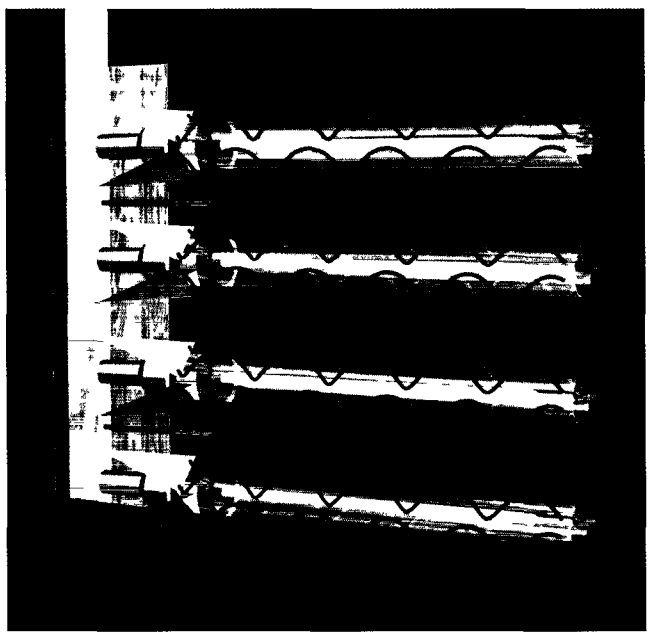
A key feature is the system's patented Delta™ mixing technology, which uses delta wings to create powerful vortices that direct all the water toward the UV lamps (see illustration this page). This mixing helps to evenly distribute the UV dose. During testing of the full-scale Aurora prototype at Dundas, Ontario, a comparison was made of the system's operations both with and without delta wings. The test data showed that the delta wings improved the efficiency of the system by 20-30 percent, without significantly affecting pressure drop.

Lamps: 75% More Powerful

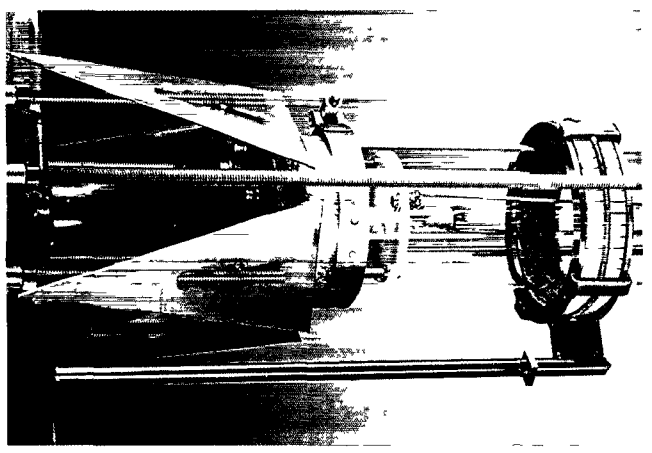
In addition to the high-performance efficiency of the Delta™ mixing technology, the 5 kW lamp used in the Aurora UV™ Disinfection System is 75 percent more powerful than any other medium-pressure lamp in the industry. For municipalities, this increased power means lower maintenance costs, since fewer lamps need to be changed.

Further, using fewer lamps creates a smaller system, which decreases installation costs. In addition to these cost savings, Calgon Carbon Corporation's proven, reliable Quickwipe™ quartz cleaning technology (see photograph above) automatically cleans the lamps, translating into fewer maintenance hassles.

Initial performance results from Dundas, Ontario, are highly favorable. All indications are that there is a new winner in wastewater disinfection: the Aurora UV™ Disinfection System.

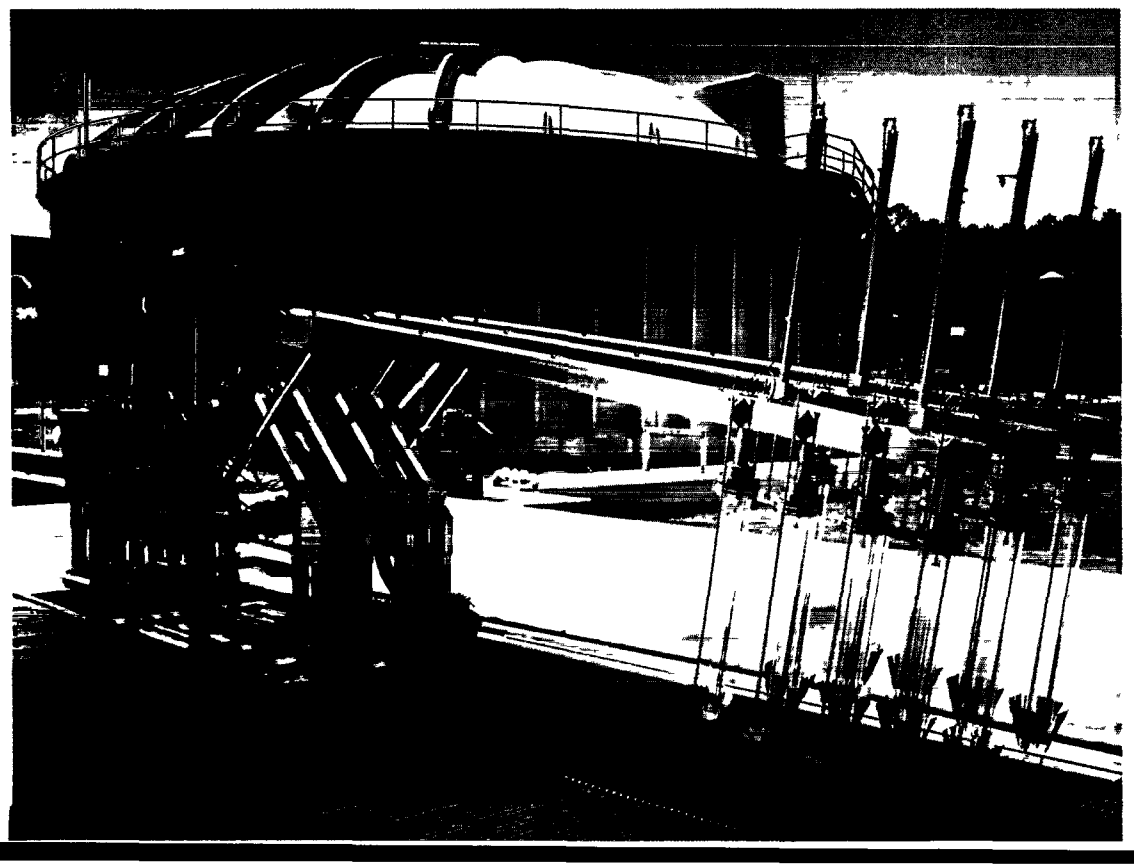


Calgon Carbon Corporation's patented Delta™ mixing technology uses delta wings to create powerful vortices that direct all the water toward the UV lamps. This innovative technology enables the Aurora UV™ Disinfection System to achieve better treatment efficiencies than existing medium-pressure technology (*patent pending)*



Automatic cleaning techniques such as Calgon Carbon Corporation's patented Quickwipe™ quartz cleaning technology allow medium-pressure lamps to have substantially lower maintenance requirements than low-pressure, low-intensity systems. (lamp shown is 5 kW)

For more information about the Aurora UV™ Disinfection System, contact Doug Reed at 905-477-9242 or E-Mail: reed@calgoncarbon.com



Calgon Carbon Corporation's medium-pressure Aurora UV™ Disinfection System at the Hinesville, Georgia municipal wastewater treatment plant. With more than 250 UV systems and more than 20,000 kilowatts of medium pressure lamps installed worldwide, Calgon Carbon Corporation is a world leader in UV technologies

UV DISINFECTION: A SAFER, CLEANER TECHNOLOGY

Disinfection is one of the most important steps in municipal wastewater treatment. There are several technologies that can be used for disinfection including chlorination, ozonation, and ultraviolet irradiation (UV disinfection). Of the estimated 20,000 municipal wastewater treatment plants in North America, approximately 60% use chlorination, 30% use chlorination/dechlorination, 8% use UV disinfection, and 1%-2% use ozonation.

While chlorination is the most commonly used technology, many municipalities are turning to alternative technologies, especially UV disinfection, for their wastewater disinfection. Why? Because chlorination has many drawbacks including: (1) toxicity of residual chlorine to other organisms in the environment; (2) creation of harmful disinfection by-products such as THMs in the chlorination process; (3) difficulty in maintaining a low total residual chlorine (TRC); (4) operator safety; and, (5) chlorine storage requirements.

Safety is the biggest problem for chlorination disinfection. The threat of chlorine gas leaks is a safety hazard for both plant operators and local communities. According to plant operators, compliance with the Uniform Fire Code will require plants to have evacuation plans for local communities in the event of a catastrophic leak. Because of this new regulation, a large public outcry against the use of chlorine is expected.

Whereas chlorination poses safety-related problems, one of the Aurora UV™ Disinfection System's main advantages is that UV disinfection is a cleaner and safer technology. Other technological advantages include no formation of disinfection by-products and no residual chlorine discharges. In addition to being safe and clean, UV disinfection is industry-proven and used at more than 1,500 municipal wastewater plants in North America alone.

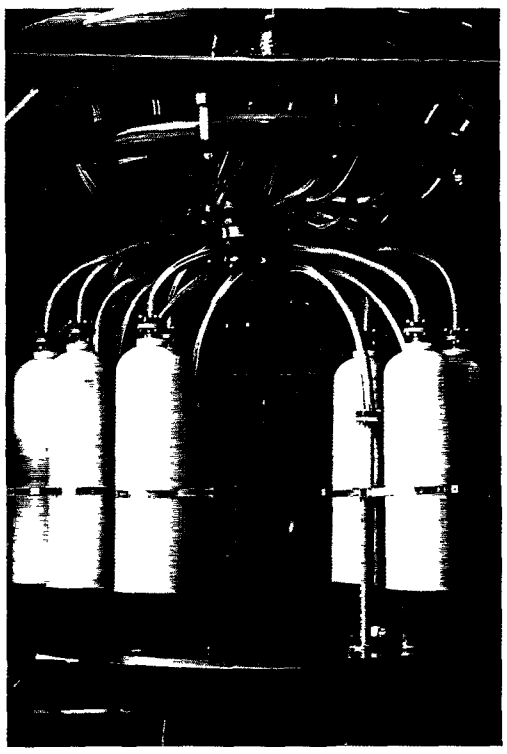
The ISEP® System—Advanced Separation Technologies Proven for Nitrate Removal Throughout the United States, and for Perchlorate Removal in California Field Trials

Calgon Carbon Corporation's ISEP® (Ionic SEParation) technology was proven successful for the removal of perchlorate from groundwater in recently completed field trials at the Big Dalton well site in Baldwin Park, California.

The month-long project, which was supported by the Main San Gabriel Basin Watermaster, was undertaken to demonstrate ISEP's® ability to reduce—on a continuous basis—the perchlorate concentration in the contaminated groundwater to below California's provisional action level of 18 ppb.

A summary of the field data, which were presented to the Board of the Main San Gabriel Basin Watermaster in August, showed that the ISEP® system's performance consistently exceeded requirements. The system reduced the perchlorate concentration in the groundwater to below the detection limit of 4 ppb. The results also demonstrated that the ISEP® treatment concurrently reduced the concentration of nitrate in the groundwater by about 60%.

The San Gabriel Valley test results confirm ISEP's® capability to reliably and consistently remove small amounts of perchlorate in contaminated water and to concurrently reduce the concentrations of other ionic contaminants such as nitrate and sulfate.



Calgon Carbon Corporation's patented Adrian MN ISEP® system is engineered to meet specific application requirements.

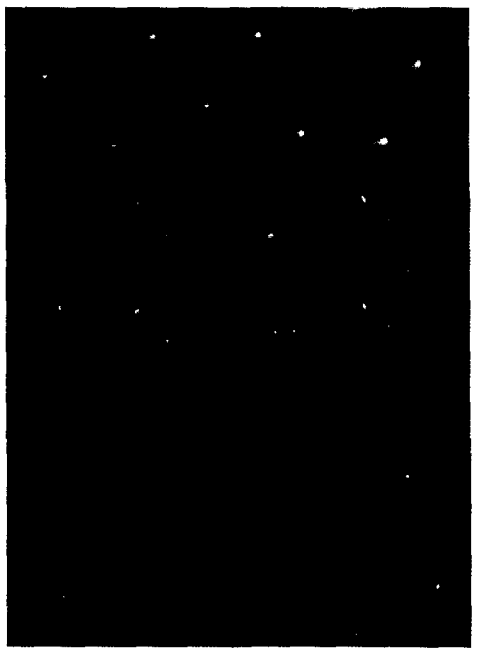
For more information about the ISEP® system, contact:
Charles Drewry at 941-474-2999 or
E Mail: drewry@calgoncarbon.com

ADVANCED SEPARATION TECHNOLOGIES (AST) APPLICATION ADVANTAGES

Calgon Carbon Corporation's patented ISEP® (Ionic SEParation) continuous ion exchange unit has many advantages:

- Cost-effective—Compared to traditional fixed- or pulsed-bed systems, the ISEP® system offers significant savings in capital and operating costs. It also significantly reduces sorbent inventory.
- Low Maintenance —With only two moving parts, distributor and carousel, maintenance is minimal.
- Flexibility—System flexibility allows a number of user functions to be simultaneously achieved under continuous operating conditions.
- Virtual Complete Recovery—Stream flows are uninterrupted, and the use of counter-current flows and recycling provides essentially complete recovery.
- Low Waste–Due to the reuse of water within the ISEP® system; as low as .2% of raw water flow.

Treating H_2S Wells With Centaur® HSL Catalytic Carbon



When high levels of H_2S (hydrogen sulfide) are detected in a well, contractors often feel they have little alternative but to cap off the well. That was the situation faced by the California Water Service Co. in 1993. Unable to cost effectively treat H_2S at one of their wells in Bakersfield, California, they reluctantly shut it down.

"We drilled the well about four years ago and capped it off when we found H_2S," recalls Bruce Cabral, water quality manager for the California Water Service Co. "Then we heard about catalytic carbon."

Catalytic Carbon

Catalytic carbon is the result of a breakthrough in altering the surface structure of activated carbon. Catalytic carbon is produced through a patented process that modifies the electronic properties of the carbon surface. The result is added catalytic functionality which is significantly greater than traditional activated carbon.

Activated carbon is typically associated with adsorption—a physical process where molecules adhere to the internal surface of the activated carbon. Catalytic carbon retains all the adsorptive characteristics of conventional activated carbons, but combines them with the ability to promote chemical reactions. In addition to concentrating reactants via adsorption, catalytic carbon promotes their chemical conversion.

Centaur® HSL catalytic carbon is specially designed by Calgon Carbon Corporation for liquid phase applications. For treatment of hydrogen sulfide in groundwater, H_2S is first adsorbed and then oxidized on the surface of the catalytic carbon. The H_2S is oxidized to sulfate and other forms which are not odorous, thus eliminating the offensive nature of the influent H_2S.

Designing a Catalytic Carbon System

To treat groundwater streams effectively with catalytic carbon, three factors must be considered: H_2S influent concentrations, dissolved oxygen, and desired flow rates. Catalytic carbon is recommended for groundwater streams where the dissolved H_2S level is less than 2 ppm. Since the reaction on the surface of the carbon involves oxidation, a minimum level of dissolved oxygen is required within the influent stream. Twice as much oxygen as H_2S is required, with a minimum dissolved oxygen level of 3 ppm. If sufficient levels of dissolved oxygen are not available, they can be supplemented with direct oxygen injection prior to the carbon bed. To allow for the complete oxidation of H_2S, it is also important to maintain a minimum contact time of five minutes.

As iron is often present in streams contaminated with H_2S, it is important to note that catalytic carbon also provides an effective treatment method for iron.

This article is excerpted from a case study that first appeared in the August 1998 issue of Water Well Journal.

For more information about Calgon Carbon Corporation's Centaur® HSL catalytic carbon, contact Dan Brooks at 412-787-6813 or E-Mail: brooks@calgoncarbon.com

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